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ORIGINAL ARTICLE

Nutritional status among pregnant adolescents at maternity teaching hospital

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ABSTRACT

Background: Adolescent pregnancy increases nutritional requirements and the risk of pregnancy complications. There are few studies about anthropometric measurements as predictors of the nutritional status of pregnancy. **Objective:** The study consisted of an assessment of nutritional status by studying the association of anthropometric index and biochemical tests with adolescent pregnancy outcomes. **Materials and Methods:** A descriptive study included 116 convenient samples of pregnant adolescents. An interview questionnaire was used for collecting the following data: socio-demographic, body mass index (BMI), height, mid-upper arm circumference (MUAC), hemoglobin levels, and proteinuria. Pregnancy complications included; anemia, urinary tract infection, mode of delivery, preterm birth, and low birth weight. Descriptive statistics, Pearson's R test chi-square, and logistic regression were all used in statistical analysis. **Results:** The majority of study subjects were of late age of adolescence (≥ 17 years), housewives with primary education, and had normal obstetric history. Multigravida was only in late age of adolescence. Most 46.9% were overweight. Primigravida decrease in overweight subjects (odds ratio [OR] 0.2^{*}; 95% confidence interval [CI] 0.03-0.88). The highest percentage had normal stature, 12.1% had short stature, 46.6 % had MUAC >28cm, and 3.4 % had undernutrition. Short stature increased at age 17 years and the risk of multipara increased in short stature (OR 4.2^{*}; 95% CI 1.2-14.4). The majority had normal pregnancy outcomes. Anemia risk decreased in the normal height group (OR=0.08^{*}: 95% CI 0.01-0.73), and in MUAC ≥ 28 cm (OR 0.77^{*}; 95% CI 0.64-0,93). The risk of low birth weight increased not significantly in late age, among MUAC 24-28 cm, and significantly in anemia (OR=**2.5***, 95% 1.1-5.5). **Conclusion:** This study concluded that the majority of the adolescents with primigravid/para status had normal nutritional status and pregnancy outcomes, as a result of growth in height, MUAC, and weight gain. malnutrition among overweight older adolescents with multigravida status affects growth, causes shorter stature, and anemia consequently increases the risk of low birth weight, preterm birth, and cesarian section. Because its effects manifest as teenage age increases in multigravida, this study supports the prevention of adolescent pregnancy. MUAC can be used to assess adolescent pregnancy complications.

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1 Introduction

The WHO defines adolescence as the phase of life between childhood and adulthood. Adolescent pregnancy and its outcome remain a public health concern in both developed and undeveloped countries, and leads to maternal and neonatal morbidity and mortality [1]. Adolescent pregnancy increased the risks of maternal complications such as anemia, infections, eclampsia and preeclampsia, emergency cesarean delivery, postpartum depression, and problems in breastfeeding initiation. In addition, unfavorable fetal outcomes include preterm births with low birth weight (LBW), a higher risk of respiratory distress syndrome, and autism later in life [2]. Early marriage, poor educational levels, low levels of sexual education and contraceptive use, and a high prevalence of poverty are all key variables in the rate of adolescent pregnancy in some traditional rural communities [3]. Adolescent pregnancy is typically seen as a high-risk group, with implications not only for the mother's emotions, education, and financial condition, but also for the mother's, child's, and community's health as a whole [4].

According to a 2014 UNICEF report, the global prevalence of LBW in developing countries is more than twice that of developed ones, with 16.5 percent compared to 7 % in developed countries [5]. [6] Al-Akaishi et al. [6] found a high frequency of teenage pregnancy in Iraq as a developing country compared to other developed countries and attributed it to cultural and religious norms. They also reported that adolescent's fertility rate in Iraq in 2012 was 69 per 1000 women aged 15-19 years whereas in Syria (42), Iran (32), Turkey (31), Jordan (26), Kuwait (14), and Saudi Arabia (10).

Nutrition in pregnancy has implications for both the mother and fetus [7]. Additional energy and nutrient demands of pregnancy during adolescent pregnancy are more than in adult pregnancy and increase the nutritional risk of adolescents. Good nourishing of adolescents during pregnancy lead to reserving adequate fat and other nutrients and compensate partially her additional requirements for her fetus [8].

Mid upper arm circumference (MUAC) measurement was used with multivariable logistic regression analysis to identify the predictors of malnutrition in adolescent pregnancy. Improving dietary practice and physical work/activity and socioeconomic status, in pregnancy are recommended [9].

Some studies explored the relationship between pregnancy outcomes and maternal nutritional status by measuring anthropometric properties [10]. Mother's anthropometry is a proximate predictor of mother's nutritional health, and pregnancy outcome [5]. Anthropometry is still an effective tool for assessing adolescent growth and nutritional status. In addition to frequently obtained data on overweight and obesity, increased monitoring and data collection on underweight, wasting, and stunting in this population is urgently needed [11]. Risk factors of obesity among teenage mothers are sociodemographic factors and physiological factors which include greater gestational weight gain and greater postpartum weight retention than adults [12]. Preeclampsia, venous thromboembolism, hypertension, gestational diabetes, postpartum hemorrhage, and a higher risk of assisted vaginal birth or cesarean section are all risks of excess weight in the mother [13].

Measuring Mid-upper Arm Circumference (MUAC) during pregnancy avoids the need for complex expensive equipment and calculations, and it is a good indicator of pre-pregnancy body fat and nutrition [14]. The majority of research has only examined MUAC before or after birth; information on variations in MUAC values during pregnancy is rare. Because MUAC has been shown to be closely related to maternal weight in studies, it has been suggested as a useful tool for screening maternal nutrition status and as a potential indicator of low birth weight (LBW), neonatal mortality, and morbidity, when weighing pregnant women is not possible [15]. Few studies focused on the detection of the best anthropometric indicators as predictors of pregnancy outcomes with greater sensitivity, specificity, and accuracy [4].

Lack of studies regarding the anthropometric index and their cut-off values as a tool of nutritional status measurement among adolescent pregnancy in Erbil city / Iraq and conflicting results about the causes of adolescent pregnancy complications enhance this study to be conducted to identify the nutritional status of adolescents' pregnancy by assessment the associations between anthropometric measurements and biochemical tests of adolescents with a pregnancy complication.

2 Patients and Methods

2.1 Study design

This was a descriptive cross-sectional study that was conducted at a maternity teaching hospital in Erbil city/ Iraq and included a 116 convenient sample of adolescents' pregnancies who attended a delivery care unit from 1st August 2018 to 31 June 2019.

Inclusion criteria: The study included apparent healthy adolescents singleton; had a pregnancy between the ages (14-18) years, were nonsmokers, and were free from taking therapeutic diets and supplements other than iron and folic acid.

Exclusion criteria: Pregnant women with obstetrical and medical complications known to affect fetal growth (such as thyroid disease) and pregnant women who did not remember their last menstrual period were excluded.

Data collection: An interview questionnaire was used for the collection of the following data; socio-demographic, obstetric history, and nutritional status assessment by; anthropometric data and biochemical tests.

Adolescent ages sub-classified according to Neinstein [16]. The current study included middle adolescence age (14 to 16) years and late (old) adolescence age ≥17 years

Anthropometric data: was measured immediately after delivery, because the study required anthropometric changes affected by the growth process during pregnancy excluding the effect of gestation and fetus weight, and included; height and weight, a calibrated digital scale was used for body mass index (BMI), and calculated by dividing the weight (kilograms) by the square of the height (meters), and mid-upper arm circumference (MUAC) of the mother. MUAC is measured by a non-stretchable tape of the circumference of the left upper arm in centimeters. The point of measurement was between the tip of the shoulder and the elbow [14]. The AnthroPlus software was used to calculate the z-score of (height and BMI) for age, and chart percentile of height for age and BMI for ages [17]. The categories of weight include: Underweight corresponds to less than the 5th percentile and < -1 z-score. Normal or Healthy Weight corresponds to the 5th percentile to < 85th percentile and < 0.99 z-score. Overweight corresponds to 85th to < 95th percentile and ≥ +1 z-score. Obese corresponds to ≥ 95th percentile or greater and ≥ +2 z-score.

Biochemical tests: HB levels (g/dl) by (HemoCue B Hemoglobin Analyzer) as a diagnostic tool for anemia.

Proteinuria (the presence of proteins, including albumin, globulin, Bence-Jones protein, and mucoprotein in the urine. Persistent proteinuria is a marker of kidney damage).

It is tested by Urine dipsticks qualitative test, and the result is expressed as positive or negative [18].

Complications of pregnancy: were diagnosed by physicians and the midwifery team of the delivery care unit.

Maternal complications: Included; mode of delivery, anemia, urinary tract infection tested by dipstick analysis (includes testing for the presence of white blood cells), gestational diabetes mellitus (GDM) (The non-GDM group was defined as those with a normal oral glucose tolerance test), and pregnancy-induced hypertension (as BP ≥ 140/90 mmHg after 20 weeks of gestation [19].

Fetus outcomes complications: Preterm birth (<37 completed weeks gestation) [20], low birth weight < 2500 g (According to the World Health Organization), and meconium aspiration (was defined as a neonate born with meconium-stained amniotic fluid) [21].

Statistical Analysis: All data were analyzed by IBM Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics; mean and standard deviation (SD) for continuous variables, Chi-square, and Pearson's R-test were used to test the association between different variables. The sample has a normal distribution. Linear and multinomial logistic regression was used to measure the odds ratio (to measure the risk of exposure and probability of an outcome in a specific period). The P-value was considered significant when $p \leq 0.05$ and was considered highly significant when $p \leq 0.01$.

Ethical Consideration: Permission from the college of nursing was obtained before data collection (Ethical application No. 88, Date 6-9-2018). In addition, informed consent was obtained from participants; they were free to participate in this study after clarifying and explaining the objective of the study.

3 Results

3.1 Characteristics of the studied sample

The mean age of the studied sample (116) was 17.6 ± 0.92 years, most were housewives with primary education; the mean gestational age was 37.6 ± 2.1, with primigravida/para status, menarche age mean was 12.6 ± 0.9 years.

MUAC ranged between (20 – 40) cm, with a mean of 28.2 ± 3.8, and a cut-off value ≤ 21 cm. The highest percentage 46.6 % of pregnant had over-nutrition MUAC > 28 cm. Maternal height, weight, and (BMI) were measured only for 66 pregnant out of 116. The mean height was 158.1± 5.5 (cm), 87.9 % of pregnant had normal stature and only 12.1% had short stature. The mean BMI was 27.1 ± 3.3. The highest percentage 46.9 % of pregnant adolescents were overweight and were in the group of z-score ≥ +1 of the obesity classification.

High percentages (77) 66.4 %, (58) 50 %, of adolescents pregnant had a normal vaginal delivery (NVD) with episiotomy, and normal hemoglobin (HB) levels (no anemia), respectively. The highest percentage (102) 87.9 %, and (111) 95.7% had no proteinuria and no pregnancy-induced hypertension respectively, while more than half 57.6 % percentage of pregnant adolescents had urinary tract infections. Most pregnant adolescents (69 %) had normal birth weight and the majority of the fetuses (83.3 %, and 80.2 %), had a normal birth, and no meconium aspiration, respectively without complications.

3.2 Sociodemographic properties and obstetric history of pregnant women

Table 1 shows that the majority of adolescents 87.1 % were in late age, 49.1% had primary education and 78.8 % were housewives. There was no significant association between age and education, while occupation showed an approximate to significant association with age, and the highest percentage of housewives 90.9 % were in old ages (≥17) years and 9.1 % were in middle age 14-16 years.

Table 2 represents obstetric history. The highest percentages 75.9 %, 83.6 %, 85.3 %, 97.4 %, and 91.4 %, of adolescent mothers, had normal gestational age (GA), prim gravid and nulli, and primiparous, with no abortion and normal menarche age respectively. Gravid and Para status was significantly associated with age; multigravida (≥ 2) was 1.6 higher than prim gravid in age progress as well as multiparous in old ages of adolescents 2.4 higher than primiparous.

Table 1. Maternal socio-demographics and their association with age

Demographic properties	Categories	n (% (n=116	χ2	p-value
Age Groups (years	Middle adolescence 14-16 years	15 (12.9		
	Late adolescence ≥17 years	101 (87.1		
Education status	Illiterate	12 (10.4	7.6	0.107
	Read and write	8 (6.9		
	Primary	57 (49.1		
	Secondary	36 (31.0		
	Institute & college	3 (2.6		
Employment	Housewife	91 (78.8	3.3	0.07
	Students	25 (21.2		

(N) = Number, **%** = percentage, GA = Gestational age, χ2 = Chi-square test, G= group, p = p-value

Table 2. Maternal obstetric history and their association with age

Obstetric properties	Categories	Age G (Years 15-16	 ≥ 17	N (% 116 (%	χ^2	p-value	OR	95% CI
GA Groups	≤ 36	3	18	21 (18.1				
	37-40	11	17	**88 (75.9**				
	≥ 41	1	6	7 (6.0				
Gravida G	**Primigravida**	**15**	82	**97 (83.6**	5.8	016*	1.6*	1.06 - 2.4
	Multigravida	0	19	19 (16.4				
Para status	**Nulli & primi ≤1**	15	84	99 **(85.3**	5.1	0.02*	2 .4	1.1-3.7
	Multiparous ≥ 2	0	17	17 (14.7				
Abortion Group	**Non**			**113 (97.4**				
	1			3 (2.6				
Menarche Age groups	≤ 11			8 (6.9				
	12-14			**106 (91.4**				
	≥ 15			2 (1.7				

(N = Number, % = percentage, GA = Gestational age, χ2= Chi-square test, OR= odds ratio, G= group, P = P value, * significant

3.3 Maternal anthropometric properties

3.3.1 Height

Height is categorized into 4 groups regarding 150 cm as cut off of short stature according to the z-score of height to age. The percentile chart of height for age consisted of; percentile < 5 is short stature. Percentile (≥ 5 to < 95) is normal and percentile ≥ 95 is tall. The chart identified that 84.8 % of adolescents were in the normal percentile ranging between (5-94) percentile, which corresponds to 153 – 172 cm with no tall stature. 15.2 % had short stature with a percentile < 5 and were present only in old age (≥ 17) years of adolescent pregnancy (Table 3).

The highest percentage 45.5 % had 151 – 159 cm height. Height for age Z-score identified that 87.9 % of pregnant had normal stature and only 12.1% had short stature. This reveals a decrease in height with an increase in age as indicated by the significant association of the z-score of height with age and a decrease in height at age 17 years compared to other ages.

Table 3. Maternal height association with demographic and obstetric history

Z-Score of height G	Maternal Age			N=66(%	χ2	p-value	OR	95% CI
	15-16	**17**	**18**		8.5	0.014*	0.15*	0.027 – 0.82
- **Normal > -2**	6	16	**36**	**58 (87.9**				
- **Short stature ≤ -2**	0	6	2	8 (12.1				
- **Percentile of height**								
- **Short < 5**	**0**	6	**4**	10 (15.2	561	0.037*	Not sig.	
- **Normal 5 – 94**	**6**	**16**	**34**	**56 (84.8**				
Z-Score of height	Gestational age G (weeks							
	≤ 36	≥ 37			18.6	0.005*	0.69*	0.49 – 0.97
- **Normal > -2**	8	**50**		**58 (87.9**				
- **Short stature ≤ -2**	2	6		8 (2.1				
Z-Score of height	Para status							
	≤ 1	**≥ 2**						
- **Normal > -2**	49	9		58 (87.9	14.9	0.001*	4.2*	1.2 – 14.4
- **Short stature < -2**	5	3		8 (12.1				
Height groups (cm	GA (week							
	≤ 36	≥ 37						
- **≤ 150**	2	7		9 (13.6	28.4	0.05*	0.66	0.43 – 1.0
- **151 – 159**	**3**	**27**		**30 (45.5**				
- **160 – 168**	5	19		24 (36.3				
- **≥ 169**	0	3		3 (4.6				

χ2= chi square, OR= Odds ratio, CI = confident interval, G = group, GA = gestational age, * =significant, p = p-value

There was a significant association between the z-score of height with gestational age and Para status and the risk of ≤ 36 weeks decrease in normal height and multipara increase in short stature. An approximate to a significant decrease in GA among short stature ≤ 150 cm compared to the 151 – 159 cm group.

3.3.2 Obesity

Table 4 shows a significant association between the z-score of BMI with age, and normal weight increase by age compare to obesity. Significant association of z-score of BMI with gestational age. Normal gestational age decreased slightly significantly in obesity compared to normal weight. Significant association of gravid status with percentile of BMI, and there was a decrease in primigravid in overweight compared to obesity.

Table 4. Maternal BMI and its association with age and obstetric history

Z-score of BMI		Age (year		(N=66 (%	R	p-value	OR	95% CI
	15-16	17	18					
- < 0.99Normal	1	3	**14**	18 (27.3	- 0.3	0.014^{*}	3.9^{*}	1.2 – 12.6
- ≥ +1 Overweigh	2	11	18	**31 (46.9**				
- ≥ + 2 Obesity	3	8	6	17 (25.8				
Z-score of BMI		GA is (weeks		(N=66 %				
	≤ 36	≥ 37						
- < 0.99 Normal	2	16		18 (27.3	0.25	0.04^{*}	0.25^{*}	0.03 – 0.19
- ≥ +1 Overweigh	7	**24**		**31 (46.9**				
- ≥ + 2 Obesity	3	**14**		**17** (25.8				
Percentile of BMI		Gravid		(N=66 %	χ2			
	Primi	Multi						
- 5 percentile < 85	13	5		18 (27.3	5.9	0.05^{*}	0.2^{*}	0.03-0.88
- ≥85 – 94	**14**	7		21 (31.8				
- ≥ 95 Obesity	**25**	2		27 (40.9				

BMI = Body Mass Index, R= Pearson's R test, Sig. = significantly, *= significant, χ2= Chi-square

3.3.3 Mid-Upper arm circumference

There was a significant association between MUAC and age (Table 5). A small percentage (3.4 %) had undernutrition and the highest percentage 75 % of study subjects with undernutrition were in late age ≥17 years. Association of MUAC with the z-score of BMI confirm Vasundhara et al. [15] who demonstrated the evaluation cut-off point of MUAC and concluded that MUAC is closely related to maternal weight. Therefore, MUAC could be classified according to BMI Z – score to underweight or undernutrition, normal weight, overweight, and obese. MUAC increased in normal ≤ 23 cm and in 24 – 28 cm over-weight compared to obesity.

3.4 Maternal outcome complications

There were significant associations between the mode of delivery (Table 6) with age groups and GA. NVD was zero in middle or younger age (15 – 16) years so increased by age but not significantly compared to caesarian section (C/S) as well as NVD with episiotomy. (C/S) decreased significantly in normal gestational age (37 – 40) weeks compared to normal vaginal delivery with episiotomy, also decreased significantly by the increase of height. Although the mode of delivery is associated significantly with MUAC but normal delivery is not increased significantly by an increase in MUAC.

Table 7 shows categories of anemia status according to WHO[22] using level (HB <11 g/dL) as a cut-off point for anemia. The percentage of anemia was 40.5 % among 116 adolescents pregnant. There was a significant decrease in anemia in normal height and the high MUAC. Urinary tract infection increased no significantly with obesity.

3.5 Fetus outcome complication

Gestational age and z-score of obesity were associated significantly with preterm birth. High GA decreased in preterm birth, while the risk of preterm increased not significantly in overweight subjects compared to full-term (Table 8). Significant association of meconium aspiration with BMI and GA ≥ 41. Meconium aspiration decreased in normal gestational age compared to ≥ 40. High BMI caused a high increase in meconium.

Table 9 shows that gestational age is associated significantly with low birth weight, and the risk of low birth weight increased 8 times in low gestational age. Maternal age is associated significantly with BW & the risk of low BW increased not significantly in late age. The birth weight was approximate to significantly associated with MUAC; low birth weight was more in MUAC 24 – 28 cm compared to normal fetus birth weight. Anemia is associated significantly with the

Table 5. Maternal MUAC and Its Association with age and Body Mass Index

MUAC Groups (Cm	Age (year			N=116 (%	χ2	p-value	OR	95% CI
	15-16		≥ 17					
	N (%		N (%					
- Under ≤ 21	1 (25		3(75	4 (**3.4**	20.6	0.05^{*}	No sig	
- Normal ≤ 23	0		11	11 (9.5				
- Overweight 24-28	9		**38**	47 (40.5				
- Over nutrition >28	**5**		**49**	**54 (46.6**				
MUAC Groups	BMI Z- score			N=66 (%				
	< .99	≥ +1	≥ +2					
- Normal ≤ 23 cm	3	4	**0**	7 (10.6	9.3	0.05^{*}	5.03^{*}	1.2 -21.6
- Overweight (24-28 cm	8	14	**3**	25 (37.9				
- Obese > 28 cm	7	13	**14**	**34 (51.5**				
Total	18	31	**17**	**66 (100**				

MUAC= mid upper arm circumference, ≤ 21cm cutoff under nutrition, G= Group, p = p value, * = Significant

Table 6. Mode of delivery association with age, gestational age, height, and MUAC

Mode of delivery	Age Groups (y				N=116 (%	χ2	p-value	OR	95% CI
	15-16		≥ 17						
- **NVD**	0		17		17 (14.7	**15.7**	**0.047^{*}**	1.4	0.66 – 2.9
- **NVD & E**	11		66		**77 (66.4**			0.8	0.47 – 1.4
- **c/s**	4		18		22 (18.9				
	GA. (weeks				**N=116 (%**				
	≤ 36	37-40		≥ 41					
- **NVD**	2	14		1	17 (14.7	16.9	$.002^{**}$	$.35^{*}$	0.004- 0.33
- **NVD & E**	13	63		1	**77 (66.4**				
- **c/s**	6	11		5	22 (18.9				
	Height (cm				66 (%				
	≤ 150	151-159	160-68	≥169					
- **NVD**	0	6	5	2	13 (19.7	3.9	0.05^{*}	0.25^{*}	-0.036-0.01
- **NVD & E**	9	24	19	1	53 (80.3				
	MUAC (cm				**N=116 (%**				
	≤21	≤ 23	24-28	> 28					
- **NVD**	0	2	5	10	17 (14.7	19.5	0.003^{**}	1.09	0.93 -1.93
- **NVD & Ep**	0	8	33	36	**77 (66.4**			1.1	0.97 – 1.25
- **c/s**	4	1	9	8	22 (18.9				

GA GAG= Gestational age group, NVD = Normal vaginal delivery, C/S caesarian section, p = p-value. NVD & E = Norma & episiotomy

Table 7. Anemia status and urinary tract infection association with anthropometric data

Anemia status (g/dL)	Percentile of height			N = 66 (%)	χ2	p-value	OR	95% CI
	Short stature		Normal					
- Hb < 11	9		24	33 (50)	7.5	0.006^{**}	0.083^{*}	0.01 – 0.73
- Hb ≥ 11	1		32	33 (50)				
Anemia status (g/dL)	MUAC (cm)			N = 116 (%)				
	≤ 23	24 – 28	> 28					
- Hb < 11	8	18	21	47 (40.5)	22.1	0.036^{*}	0.77^{**}	0.64 – 0.93
- Hb ≥ 11	7	29	33	69 (59.5)				
Urinary tract Infection	Percentile of obesity			N = 66 (%)				
	5 – < 85	≥85 – 94th	≥ 95					
- Infection	9	12	17	38 (57.6)	4.66	0.097 Not Sig.		
- No infection	9	9	10	28 (42.4)				

HB = hemoglobin. p = p-value.

fetus's birth weight. Risk of low birth weight increased significantly by 2.5 times among pregnant who had anemia.

Table 8. Fetus outcome complications, and its association with maternal properties

Type of Birth	GA (week)			N (%)	χ2	p - value	OR	95% CI
	≤ 36	37-40	≥40	116 (%)				
- **Preterm**				**95 (83.3)**	97.1	≤ 0.01**	0.047*	0.01 – 0.205
- **Full term birth**				21 (16.7)				
Type of birth	**Z Score of BMI**			**N (%)**				
	< 0.99	**1 – 1.99**	**≥ 2**	**66 (%)**				
- **Preterm**	2	9	0.0	11 (6.7)	10.38	.006**	3.2	0.55 – 18.4
- **Full term birth**	23	17	15	**55 (83.3)**				
Meconium Asp.	**Z Score of BMI**			**N (%)**				
	< 0.99	**1 – 1.99**	**≥ 2**	**66 (%)**				
- **Meconium**	0	4	5	9 (13.6)	6.4	0.04*	4.98*	1.3 – 18.7
- **No meconium**	18	27	10	**57 (86.4)**				
Meconium Asp.	**Gestational age**			**116 (%)**				
	≤ 36	**37 – 40**	**≥40**					
- **Meconium**	0	17	6	23 (19.8)	24.3	0.00**	0.04**	0.005 – 0.35
- **No meconium**	21	71	1	**93** (80.2)				

Asp. = Aspiration, * significant, ** = high significance

Table 9. Fetus birth weight association with maternal properties

BW* (kg)		Maternal Age			N (%)	χ2	P-value	OR	95% CI
		15- 16		≥17	116 (%)				
	< 2.5	5		**31**	36 (31)	11.9	0.018*	1.44	0.91 – 2.3
	> 2.5	10		70	80 (**69**)				
BW (kg)		**Gestational Age**							
		≤ 36	**37-40**	**≥ 41**	**116 (%)**				
	< 2.5 kg	**16**	18	2	36 (31)	24.6	<.001 **	8*	1.2 – 54.7
	> 2.5 kg	**5**	70	5	80 (69)				
BW (kg)		**MUAC (cm)**			**N (%)**				
		≤ 23	**24-28**	**> 28**	**66 (%)**				
	< 2.5 kg	0	**9**	6	15 (22.7)	5.0	0.07	1.3	0.34 – 5.2
	> 2.5 kg	7	**16**	28	51 (77.3)	7			
BW (Kg)		**Anemia (g/dl)**			**116 (%)**				
		< 11		**> 11**					
	< 2.5	**20**		16	36 (31)				
	> 2.5	27		53	80 (69)	4.9	0.027*	**2.5***	1.1 – 5.5

BW= Birth Weight, sig = significant, * significant, ** highly significant

4 Discussion

Nutritional status during, before, and after pregnancy is essential and affected by sociodemographic factors, obstetric history, and dietary habits.

4.1 Sociodemographic properties and obstetric history

These properties of the studied sample indicate to old housewife adolescent pregnancy with primary education among adolescents. It is consistent with Ali et al. [23] who found the majority of teenagers' pregnancies were illiterate, housewives, with moderate economic status.

Normal obstetric history, especially among late-age adolescents reflects normal physiological development. Multigravida and Para status increase in late age is in line with Glick et al. [24] who stated advanced maternal age is a known risk factor for multiple gestations in naturally conceived pregnancies that result from multiple ovulations associated with higher maternal follicle-stimulating hormone (FSH) levels.

4.2 Anthropometric properties

Anthropometry indicated normal growth in both stature and gestational weight gain especially in 15 – 16 years of age who had normal stature, also late age with nulli and primipara status during adolescent pregnancy. Effect of gestation accumulated and was apparent among late age who had short stature, low gestation, overweight adolescents, and multi-gravid as found by the PAHO and the WHO [25] who concluded that women who had two or more pregnancies gained about the same amount of weight as women who had one pregnancy but lost much more height and a negative effect of adolescent pregnancy on height was only evident after two pregnancies, while one adolescent pregnancy was associated with greater BMI. Association of BMI with gestational age, gravid status, and MUAC indicate weight gain, and subcutaneous fat storage at central sites in primigravida/Para at a late age and middle age of adolescent pregnancy and agree with studies that have shown that growing adolescent girls when becoming pregnant, they accumulate fat more differently than adult women, growing adolescents continue to accrue fat rather than mobilize fat stores after 28 weeks of gestation, like no growing adolescents and adults [11]**.** Vivatkusol et al. [26] concluded that a majority of teenage mothers had improper weight gain, especially overweight gain. Also, Ganchimeg [27] who concluded that after week 28, (end of the second trimester), growing adolescents failed to lose fat and tended to continue to accumulate fat in their upper arm fat area compared to mature adult women and non-growing adolescents, both will lose fat from their upper arms and back.

4.3 Maternal Outcome

The results showed that 40.5% of pregnant women had anemia and 18.9 % had cesarean deliveries, respectively and it is in agreement with Al-Akaishi et al. [6] who found 38.6 %, of anemia and 8.6% teenage mothers had severe anemia, and 22.6 % had cesarean section in Al-Zahraa Teaching Hospital in Al-Najaf governorate /Iraq. Abnormal delivery decreases in normal gestation and increases in short stature. It is in line with Kuritani et al. [28] who reported that emergency cesarean delivery was higher in shorter women and shorter women have narrower pelvises due to genetic and environmental factors. and Mogren et al. [29] concluded that short-statured women with larger baby size have a higher incidence of emergency cesarean delivery and Maira et al. [30] concluded that pregnant women with maternal height less than 156 cm demonstrated a higher BMI (overweight) and increase risk factors for cesarean section.

The increase in risk of anemia by low gestational age, short, and low MUAC may be due to the increased iron requirement induced by the imbalance between nutrient intake and their growth and gestation as stated by Jeha et al. [2] and Gonete et al. [31] who concluded that anemia is a global public health problem affecting both developing and developed countries and it is more among adolescent girls as a result of their rapid growth, and menstrual loss. This result conforms to results of previous research on adolescent pregnancy in Iraq [32] that teenage pregnant 17-19 years had a higher risk of anemia and Abdulla and Azize [33] who concluded that anemia was a more frequent complication presented in the adolescent group.

Munares-García and Gómez-Guizado [22] concluded that pregnant women with short stature have a higher proportion of anemia than those without short stature, which is mainly associated with adolescence.

Pregnant adolescents with urinary tract infections may be due in general, to physiologic changes associated with pregnancy which was common among adolescents especially (overweight and obese) and it is in line with Dobner and Kaser [10] who found that lower urinary tract infections occur more frequently in teenage pregnancies compared with young adult pregnancies, and Gibbs et al. [34] stated that both obesity and underweight have been found to increase infection risk in U-shaped manner. Several studies indicate that normal weight is associated with the lowest infection risk in most subjects**.** Also reported that BMI ≥ 30 kg/m^2 is a risk factor for urinary tract infections by alteration in the immune system.

4.4 Fetus Outcomes

Majority of fetus outcome was normal, which may be due to the protective effect of overweight which is consistent with Sámano et al. [35] concluded that overweight was a protective factor for low birth weight and small for gestational age fetus. This also confirms the results of previous researchers who concluded that heavier women are less likely to have a pregnancy complicated by a small-for-gestational-age newborn or intrauterine growth restriction, but if the maternal BMI reaches the level of obesity (> 30 kg/m^2), this protective impact appears to fade [36], also with Patric and Robert [37] who wrote that adverse pregnancy outcome are increased and amplified with increasing severity of the obesity.

Preterm was 16.7 % and decreased by normal gestational age. Low birth weight was 30.1 % and increased with the increase in age which may be attributed to the effect of decreased GA; in short stature & anemic (as shown in Tables 3 and 6), overweight especially at age 17 years (as shown in table 4) which had high gravid/para status in late age (Table 1).

Low birth weight associations with anemia status agree with Sámano et al. [35] who concluded that biological effects of young age (<15 years) at first pregnancy on infant health, which could be through increased risk of preterm birth and low birth weight and increased risk of maternal anemia. It is in line with Banerjee et al. [38] who found that anemia, preterm delivery, and low birth weight were more prevalent among teenagers than among women who were 20 – 24 years old. Also, Figueiredo et al. [39] after accounting for maternal age, family income, urinary infection, parity, alcoholic beverage use during pregnancy, and gestational BMI, they discovered that maternal anemia was a risk factor for low birth weight.

Results showed that high gestational age ≥ 40 and maternal obesity increased the risk of meconium. This conforms result of Narchi and Skinner [40] who demonstrated that only neonatal macrosomia and meconium aspiration syndrome remain significantly associated with maternal overweight and obesity, and Gibbs et al. [34] who reported that macrosomia and excessive fetal growth are frequently associated with pre-pregnancy excess weight.

Increased preterm in overweight and low birth weight in MUAC 24 – 28 cm may be due to more multigravida status in overweight subjects. This result is in agreement with Njim and Agbor [41] who found LBW in multiparas compared to primiparas and attribute it to their previous obstetric history. This was confirmed by the presence of 60% of low-birth-weight fetuses among 24-28 cm MUAC and it is consistent with Ganchimeg et al. [27] who found that adolescents tended to continue to accumulate fat in their upper arm fat area.

4.5 The primary findings of this study

There was no risk of adolescent pregnancy in the majority of adolescents with nulli and primipara which agrees with Masoumi et al. [42] who concluded that the risk of poor pregnancy outcome is not higher in teenage pregnancies compared to pregnancies in the 20 to 35 years age group if confounding factors, controlled. Additionally, determination cut-off points of MUAC (≤ 21 cm) and height (≤ 150 cm) for the mode of delivery, and anemia.

5 Conclusions

This study concluded that hemoglobin level and anthropometric measurements (BMI, MUAC, and height) determined normal nutritional status and pregnancy outcomes among the majority of the pregnant adolescents with nulli and primipara which had standard stature, high mid-arm circumference, and weight gain. In contrast to the malnutrition status that was among older adolescents who were overweight and had multigravida, short stature, and anemia, which caused an increased risk of infection, low birth weight, preterm delivery, and cesarean section.

Limitations of the study: This is a cross-sectional study, with a small sample size, especially of young age adolescents in one hospital in an urban area. The study also not included adolescents who had given birth at home.

Recommendation: This study confirm the prevention of adolescent pregnancy. Because its effect appears in multigravida with progress of age which affects the growth of adolescents and the outcome of pregnancy and results in pregnancy complications. By raising public awareness, providing female education, and upholding marital law, the government can help women of reproductive age to start pregnancies with a sufficient and healthy weight

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